ART DUDLEY

# CanEver Audio UnoZero

## D/A PROCESSOR


It's the sad realization at the heart of every product review: No matter what the writer has to say, the reader may hear things—or see or feel or taste things—rather differently. I refer not only to physiological differences in hearing acuity from person to person, but also to the no-less-critical differences in the ways we process and prioritize the things we perceive. It's an oft-made point that bears any amount of repetition: In our pugilistic little pastime, the priorities of the listener who values, say, fidelity to the musical timing captured in a recording over fidelity to that recording's timbral truths are no less legitimate than those of the enthusiast whose priorities are the other way around. Both approaches—and any number of others—bend toward the sun of high fidelity.

A case in point is the ZeroUno DAC ($7990), the first product from CanEver Audio, an Italian firm. By the end of its stay in my home, it had pushed virtually all of my Happy buttons—not by doing everything I could ask of it, but by having a point of view that aligned with my own. But even now, as I praise its sound quality and its apparently reasonable level of value for the money, I'm less sure than usual whether I liked this product because it agreed with me or because it was *right*. But I'm getting ahead of myself . . .

**The ZeroUno looks more like a low-power tubed amplifier than a DAC.**

### Description

The single-box CanEver ZeroUno breaks convention by looking more like a low-power tubed amplifier than a DAC: the top of its steel enclosure, which measures 15.5" wide by 13.5" deep, is occupied by two Psvane CV181 dual-triode vacuum tubes and three soup-can–sized cylinders that bring the ZeroUno's overall height to 8". It isn't hard to imagine a mains transformer and a stereo pair of output transformers inside those cylinders, but the reality is slightly different. The cylinders at the sides contain toroidal transformers: the one on the left for the tubes' heater filaments, the one on the right for the digital circuitry. Inside the central can are *two* toroidal transformers: one for the two tubes' output stages, the other for the DAC's analog circuitry.

The front panel is attractively simple. Flanking an LCD display screen are two 1.5"-diameter knobs: on the left a

### SPECIFICATIONS

**Description** Digital-to-analog converter. Tube complement: two CV181 (6SN7). DAC: ESS Sabre32 ES9018. Input formats: 44.1, 48, 88.2, 96, 176.4, 192, 352.8, 384kHz; DoP at DSD64, DSD128. Digital inputs: S/PDIF (optical, 96kHz and below), S/PDIF (BNC & RCA, 192kHz and below), USB 2.0. Analog outputs: single-ended on RCA and XLR jacks. Maximum output voltage: 1.77V RMS. Output impedance: <1 ohm. **Dimensions** 15.5" (400mm) W by 8" (183mm) H by 13.5" (360mm) D. Weight: 22.22 lbs (10.1kg).

**Serial number of unit reviewed** 1609-018-08. **Price** $7990. Approximate number of dealers: 6. Warranty: 2 years (tubes excluded). **Manufacturer** CanEver Audio, Panfilo Castaldi 6, 30020 Noventa di Piave, Venice, Italy. Tel: (39) 335-708-2-807. Web: www.canever.eu. US distributor: Fidelis Music Systems, 460 Amherst Street (Route 101A), Nashua, NH 03063. Tel: (603) 880-4434. Web: www.fidelisav.com.

rotary power switch, on the right a knob that addresses a 32-bit internal volume control. Also on the front are two pushbuttons: Input selects between the ZeroUno's four inputs—USB, S/PDIF BNC, S/PDIF RCA, and S/PDIF optical—and Setup's jobs I'll describe in the next section. Around back are one pair each of RCA and XLR output jacks, both carrying a single-ended signal, and jacks for the four inputs listed above. CanEver says that an AES/EBU jack can be substituted for the BNC input jack, if desired.

As for the CV181s, which are equivalents of the more commonly seen 6SN7 tube, designer Mario Canever told me in an e-mail that they're used "to match the signal transfer between the output stage of the ZeroUno DAC, the connecting signals cables, and the input values of the . . . amplifier." Voltage gain for the ZeroUno's output stage is provided by an interstage transformer before the tube—as Canever observes, "it works as a step up transformer"—mounted on the substantial main circuit board.

At the heart of the ZeroUno is an ESS Sabre[32] ES9018S chip, its eight internal differential DACs used in a quad-sum configuration. Apparently, considerable engineering effort went into the ZeroUno's digital and analog filtering. As Mario Canever explained, sigma-delta DACs such as the Sabre are often wrongly criticized for generating excessive noise: "This 'noise' is really the same useful signal you listen to with your ears, *plus* the same signal, but shifted in frequency. Knowing the exact nature of this 'noise,' it is simple to filter it." Canever's solution is to apply his own digital filter designs—an infinite impulse response (IIR) filter for DSD and finite impulse response (FIR) filters for PCM, implemented in the Sabre chip—plus his own stereo analog filter, placed between the Sabre and the ZeroUno's output stage. "Upgrades are possible," he added, "while making changes to [this] proprietary firmware."

## ... USB AUDIO 2.0 ...

The ZeroUno's USB input board, which is separate from its main circuit board, is designed around an XMOS chip, and offers a standard USB 2.0 interface. No additional drivers are required for use with Apple OS or Linux systems; driver-installation instructions are provided for Windows users. In late 2016, when my review sample was supplied, the ZeroUno was described as supporting, via its USB input, PCM up to 384kHz as well as DSD over PCM (DoP) up to DSD128. (Separate crystal-oscillator clocks are included for sampling rates of 44.1 and 48kHz and their multiples.) Canever says that the ZeroUno will soon be able to support MQA, by means of a retrofittable USB input board the company plans to introduce in May 2017, at the High End show in Munich.

Finally, a few words are due the ZeroUno's power-supply section, which reportedly benefits from a concentrated effort to achieve low noise and high independence of individual circuits. All those individual toroidal transformers noted above contribute to this independence. So, too, does the fact that the USB receiver board is given a high degree of electrical isolation from just about everything else, given that it's powered not by the lousy 5V on the USB bus, but by a "quasi-battery" power supply. Overall, the ZeroUno's power supply is claimed to contain 13 individual coupling inductors, and is built using "aluminum organic solid polymer" capacitors instead of electrolytic types.

### Installation and Setup

Usually, there's not much to say about setting up a new USB DAC with an Apple iMac: You connect the two with a USB link (I used a 2m AudioQuest Carbon), select the new output device in the iMac's System Preferences window, and,

## MEASUREMENTS

I measured the CanEver UnoZero with my Audio Precision SYS2722 system (see the January 2008 "As We See It," http://tinyurl.com/4ffpve4), using both the Audio Precision's optical and electrical digital outputs and USB data sourced from my MacBook Pro running on battery power with Pure Music 3.0 playing WAV and AIFF test-tone files. Apple's USB Prober utility identified the CanEver as "xCORE USB Audio 2.0" from "XMOS," and confirmed that its USB port operated in the optimal isochronous asynchronous mode. Apple's Audio-MIDI utility revealed that, via USB, the UnoZero accepted 24-bit integer data sampled at all rates from 44.1 to 384kHz. The optical and electrical S/PDIF inputs locked to datastreams with sample rates up to 192kHz. I started the measurements with the CanEver DAC set to its factory defaults: Jitter filter on, Oversampling filter on, and resolution at "9 bits pseudo." All the measurements were taken from the single-ended RCA jacks; the XLR jacks don't offer a balanced output but duplicate the single-ended outputs.

With the volume control set to its maximum of "0dB," the maximum output level at 1kHz was 1.7V, which is 1.4dB lower than the CD standard's 2V. The outputs preserved absolute polarity (ie, were non-inverting), and the output impedance at middle and high frequencies was a moderate 850 ohms. This rose to 7800 ohms at the bottom of the audioband, presumably due to the presence of an output coupling capacitor following the single-ended tube stage. The specified impedance of <1 ohm is erroneous; the UnoZero needs to be used with a preamp or power amp having an input impedance of at least 40k ohms if the low frequencies are not to sound a little lean.

The Sharp and Smooth FIR reconstruction filters are available only with USB data, which the UnoZero's display identifies as "i2s." Similarly, the option of turning off the oversampling filter is not possible with S/PDIF data—you can turn it off, but the DAC then loses lock with the incoming datastream. Figs. 1 and 2 respectively show the DAC's impulse response with the Sharp and Smooth filters—both are linear-phase types with time-symmetrical ringing, but Sharp is a conventional long filter, Smooth a very short filter. The impulse response with the oversampling filter turned off is shown in fig.3—it looks like the impulse

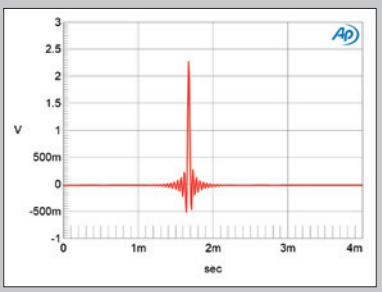


**Fig.1** CanEver UnoZero, Sharp filter, impulse response (one sample at 0dBFS, 44.1kHz sampling, 4ms time window).

if necessary, dink around with the settings of your music-playback software until everything works.

This time, things were different, given that I'd recently switched to the Roon music-playback app (v.1.2, Build 165), having been inspired by Jon Iverson's and Michael Lavorgna's very positive reports on same.[1] While this is neither the time nor the place to kill several hundred innocent words in an attempt to describe my experiences with it, I'm impressed with Roon's metadata-intensive and generally (but not consistently) high-level interface, while I consider its sound to be at least as good as that of Audirvana and Decibel, my previous favorite players.

It turned out that Roon is also amenable to changes in hardware—*so* amenable that my efforts at futzing around with my iMac's Audio MIDI Setup screen only made things worse. Michael Lavorgna advised me to simply let Roon sort things out, so I rebooted computer and DAC alike, then simply clicked on the appropriate audio-output device—labeled xCORE USB Audio 2.0—in the iMac's System Preferences window. From that point forward, all worked well: The ZeroUno DAC adapted, easily and instantly, to changes in file resolution, and its LCD screen correctly displayed all music-file sampling rates.

All told, the ZeroUno has ten user-adjustable functions: three affecting the brightness of the LCD display and the size of certain characters thereon, and seven affecting various aspects of performance. Some of the latter, such as adjusting channel Balance and inverting Phase (absolute signal polarity), are self-explanatory, but the purposes of the rest range from obscure to full-bore WTF, and none is explained in the owner's manual. These are: Oversampling Filter (On/Off, default On); Jitter Filter (On/Off, default On); FIR Filter, for USB only (Smooth/Sharp, default Smooth); IIR Filter, for DSD only (Maximum/Medium/Minimum, default setting not indicated); and DAC Resolution (6, 7, 8, or 9 bits—but given the lack of explanation, the choices might as well be Goldfish, Hamster, Kitten, or Puppy).[2]

I spent weeks listening to the ZeroUno in its default mode, and with its digital Volume control turned all the way up (*ie*, 0dB of attenuation). The only one of the DAC's ergonomic and performance functions that interested me was the ability to play around with signal polarity. A repurposed Apple remote handset is supplied with the ZeroUno, and its Phase button is, wisely, the largest and most centrally located control on the whole blessed thing. So that's the only user control this user used . . . for a while.

Then something odd happened: In a moment of clumsiness, I accidentally disconnected the 2m USB link between the ZeroUno and my iMac, and when I reconnected it, my computer would no longer communicate with the DAC. The ZeroUno was still a selectable option in the iMac's System Preferences, again as xCORE USB Audio 2.0, but it would not *remain* selected.

So I hard-rebooted everything, including the CanEver ZeroUno, then reselected the ZeroUno in System Preferences. Now it stayed selected—but the unit's display remained resolutely dark. Initiating the Setup procedure—accomplished by pressing the Setup button for more than 2 seconds but fewer than 10—illuminated the screen at what I assume was its dimmest setting. Music played, it sounded fine, and I could still use the handset to invert signal polarity, as desired. But I soon realized that, while the manual instructs the user how to enter Setup mode, and how to cycle through the various

1 See www.stereophile.com/content/roon-labs-roon-v10-music-playback-app and www.audiostream.com/content/roon-page-2.

2 I will discuss the sonic differences between the filters in a follow-up review.

**measurements, continued**

response of an analog low-pass filter.

With 44.1kHz-sampled white noise, the Fast filter offered a rapid rolloff above 21kHz (fig.4, red and magenta traces), with almost complete elimination of the aliased image at 25kHz of a full-scale 19.1kHz tone (blue, cyan). The Smooth filter offered a much slower ultrasonic rolloff (fig.5), and I had to reduce the level of the 19.1kHz tone by 3dB in this graph to avoid the spectrum filling up with aliasing products. (As AD's auditioning was performed exclusively with the Smooth filter, I suspect that this behavior correlates with his finding the "strings had texture, but also a bit of fuzz: too much texture, if you can imagine such a thing." Without the oversampling filter (not shown), the high-frequency rolloff slope was shallow, with aliased images abundant both within and above the audioband.

With S/PDIF data, the default reconstruction filter appears to be identical to the Sharp filter with USB data. Fig.6 shows the frequency response with that filter and with data sampled at 44.1, 96, 192, and 384kHz. Other than a sharp rolloff below each Nyquist frequency (half the sample rate), the

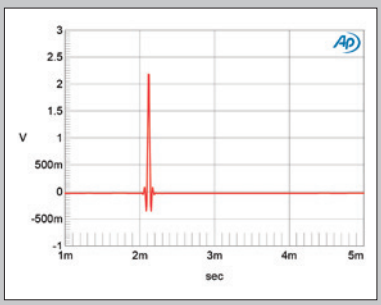


**Fig.2** CanEver UnoZero, Smooth filter, impulse response (one sample at 0dBFS, 44.1kHz sampling, 4ms time window).

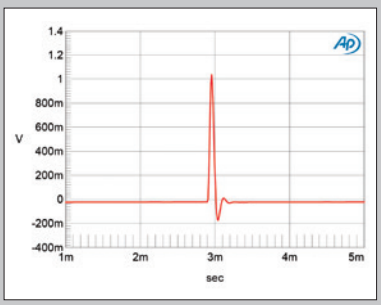


**Fig.3** CanEver UnoZero, Oversampling filter off, impulse response (one sample at 0dBFS, 44.1kHz sampling, 4ms time window).

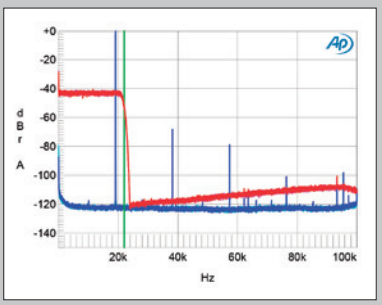


**Fig.4** CanEver UnoZero, Sharp filter, wideband spectrum of white noise at -4dBFS (left channel red, right magenta) and 19.1kHz tone at 0dBFS (left blue, right cyan), with data sampled at 44.1kHz (20dB/vertical div.).

settings *within* each function using the Volume knob, it offers not the slightest idea of how to move *between* functions; *eg*, Phase, Balance, Jitter Filter, etc.

While in Setup mode, I tried to advance through the functions by again pressing the Setup button for longer than 2 seconds, but that didn't work. Then I tried pressing the Input button, but that didn't work either. Finally and entirely by accident, I held the Setup button for *less* than 2 seconds, and that did the trick: I was at last able to make my way to the LCD Brightness screen and to restore—you guessed it—LCD brightness. I could have gone on through all the other functions and adjusted them, too, if I'd wanted to, but I no longer did. Consequently, all the remarks that follow are based on listening to the ZeroUno in its default mode.


Jjhc vgsk chjvb kajchv bkja vbk qjhv bkq jhvb kqjhvb kqhj vbk ajhvb khjqvb.

**The Italian DAC allowed the music exceptional and truly analog-quality momentum.**

## Listening

The first music I enjoyed through the CanEver ZeroUno was Daniel Barenboim's *On My New Piano* (24/96 download, Deutsche Grammophon), a collection of works for solo piano by various composers, played on a unique, straight-strung piano conceived by Barenboim and built by Chris Maene using mostly Steinway parts. The album is exceptionally well recorded, and through even a $200 AudioQuest DragonFly DAC leaves little doubt as to the instrument's size and sheer power. The ZeroUno took those revelations considerably further, presenting the Barenboim-Maene as an instrument with a slightly different timbral balance and an apparently limitless well of texture—and Barenboim as a player who can raise the hairs on the back of my neck without resorting to garishness.

But getting back to that instrument's sound: Through the ZeroUno more than the other DACs at my disposal, Barenboim's new piano sounded, pardon the expression, just a little less *hi-fi* than what I'm used to hearing from contemporary recordings: it had more tonal character—again, in addition to its bass power and its abundance of texture. Yet credit is also due the ZeroUno for so explicitly describ-

**measurements, continued**

response at the lower rates follows the same shape: a slight boost in the low bass and an ultrasonic peak (+1.8dB at 80kHz). The response with 384kHz data (blue and gray traces) extends to above 100kHz, but then rolls off sharply before reaching the data's 192kHz Nyquist frequency. Fig.7 shows the frequency response with 44.1kHz data with the oversampling filter on (blue and red traces) and off (green, gray). To my surprise, the DAC's output with the filter turned off drops off sharply in the mid-treble, reaching –3dB at 7kHz. The HF cutoff increases with the sample rate—eg, with 96kHz data, the response is now –3dB at a more acceptable 15kHz—but providing the ability to turn off the oversampling filter seems perverse.

Channel separation was excellent, at >110dB below 10kHz. With its use of a tube stage, I expected to see power-supply-related spuriae in the UnoZero's output. However, these spuriae—almost all odd-order harmonics of the 60Hz power-line frequency—

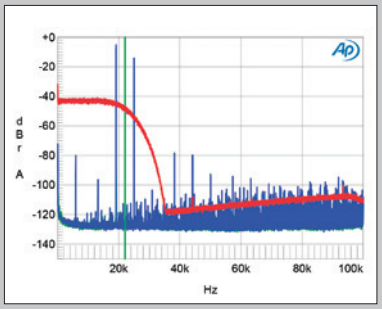


**Fig.5** CanEver UnoZero, Smooth filter, wideband spectrum of white noise at –4dBFS (left channel red, right magenta) and 19.1kHz tone at 0dBFS (left blue, right cyan), with data sampled at 44.1kHz (20dB/vertical div.).

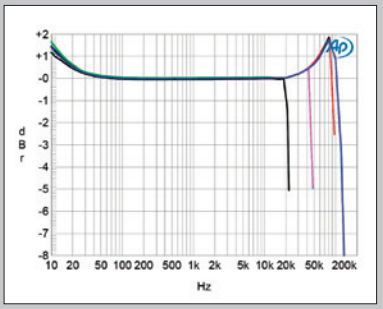


**Fig.6** CanEver UnoZero, Sharp filter, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red), 384kHz (left blue, right gray) (1dB/vertical div.).

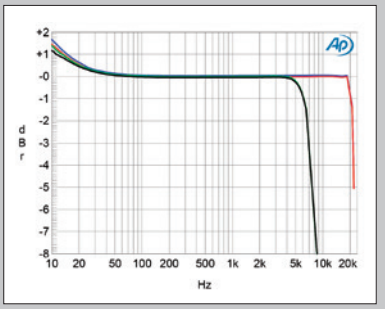


**Fig.7** CanEver UnoZero, frequency response at –12dBFS into 100k ohms with data sampled at 44.1kHz and: Oversampling filter off (left channel green, right gray), on (left blue, right red) (1dB/vertical div.).

ing the differences between this and other pianos in other recordings—the latter including the one played by Mieczyslaw Horzsowski, then 98 years old, in a concert recording that included Schumann's *Papillons* (AIFF from CD, BBC BBCL 4122-2): There, the highest notes rang like crystal—soothingly, not glassily—in comparison to the meatier trebles heard from the Barenboim-Maene. (In the Horzsowski, the sound of the room is also more generous and more beautiful.) More important was how the ZeroUno put across Horzsowski's comparatively light touch and slightly more mechanical, but never unmusical, tempi.

Orchestral music was similarly impressive through the ZeroUno, albeit with exceptions. The first such recording I tried was of Franz Schmidt's Symphony 4, by Martin Sieghart and the Bruckner Orchestra Linz (AIFF from CD, Chesky CD143)—one of those rare audiophile recordings that's actually a better performance than most mainstream releases now available. But it left me slightly ambivalent: on hearing the solo trumpet that opens the first movement, I had the drearily audiophilish notion that the sound was freighted with an overabundance of harmonics—the instrument didn't sound as brassy and clear as it should. Similarly, the strings had texture, but also a bit of fuzz: too *much* texture, if you can imagine such a thing. (Sometimes, I can't.)

A better orchestral outing was the stereo version of Fritz Reiner and the Chicago Symphony Orchestra's 1955 recording of Beethoven's Symphony 7 (AIFF from CD, JVC JMCXR 0006). Here, too, I felt that the violins had a slight overabundance of texture, especially when vigorously played. But those were small potatoes compared to the really remarkable—and sadly rare for digital—abundance of momentum and drive I heard through the ZeroUno. Perhaps because the Seventh is the most rhythmically intense and varied of Beethoven's symphonies (Wagner praised it as "the apotheosis of the dance"), it gave the CanEver DAC a fine opportunity to show off its clearly superior temporal performance, from the thrust of the cello's ascending figures in the first movement, through the driving pizzicato notes in the *Allegretto* (which tends to flag somewhat under other batons, though not Reiner's), to the final movement's borderline drunken revelry. Again, digital components that keep orchestral warhorses this *electric* are rare.

During much of my listening, I compared digital files with LP versions of the same recordings. So it was with the Ornette Coleman Trio's *At the "Golden Circle" Stockholm, Volume One* (24/192 download, Blue Note/HDtracks). This sounded very tactile, immediate, and compelling through the ZeroUno. "Faces and Places" came across as the near-frantic yet never less than purposeful and single-minded whirlwind that it is, and the impact of Charles Moffett's drumming was particularly impressive: almost 78 quality, let alone LP quality!

Moffett banging away at the edge of his ride cymbal created a deeper, blacker pool of sound from the LP (Blue Note ST-84224, in a bog-standard Universal reissue) than from the download, and it was easier to pick up on and make sense of the rhythm and tempo established early in the piece by bassist David Izenzon. But the LP of this recording sounded timbrally muffled compared to the download played through the ZeroUno. The LP had more bass *oomph* and just a hair more bass *swing*, but through the DAC there was much greater clarity, particularly in the bottom octaves. Some details higher in the audioband—Moffett's hi-hat work, for example—were also easier to hear via the ZeroUno.

A more exemplary moment arrived when I compared the

**measurements, continued**

are all close to or below –110dB ref. full scale (fig.8), and so should not be audible. However, the presence of very low-frequency or "flicker" noise moves the waveform of an undithered tone at –90.31dBFS away from the time axis (fig.9). The three DC voltage levels are well defined, however, and the level of higher-frequency random noise is low enough to allow the Sharp filter's ringing to be seen. The analog noise floor was low enough that when I changed the bit depth of the incoming data from 16 to 24 with a dithered tone at –90dBFS, the floor dropped by 18dB (fig.10), implying resolution of at least 19 bits.

Harmonic distortion was relatively low, as long as the load impedance was high. Fig.11 shows the spectrum with the UnoZero reproducing a full-scale 50Hz tone into 100k ohms. The second and third harmonics are almost equal in level, but at –80dB (0.01%) are negligible. The levels of the distortion harmonics increased, however, with loads below 10k ohms. When I tested the CanEver for intermodulation distortion with an equal mix of 19 and 20kHz tones, the combined waveform peaking at 0dBFS, and with the Sharp filter on (fig.12), the second-order or difference product at 1kHz lay at a respectable

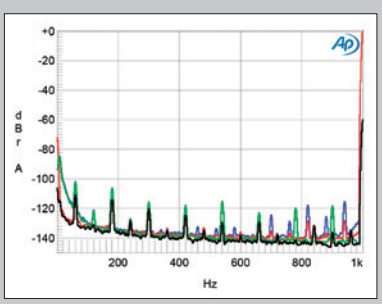


**Fig.8** CanEver UnoZero, spectrum with noise and spuriae of dithered 24-bit, 1kHz tone at: 0dBFS (left channel blue, right red), –60dBFS (left green, right gray) (20dB/vertical div.).

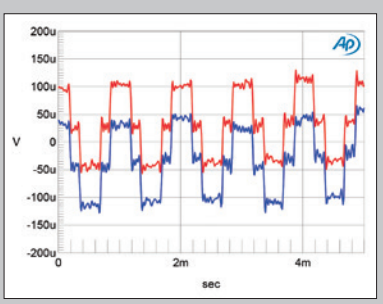


**Fig.9** CanEver UnoZero, waveform of undithered 1kHz sinewave at –90.31dBFS, 16-bit data (left channel blue, right red).

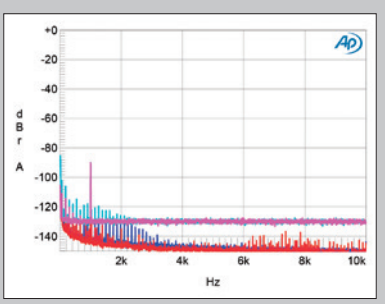


**Fig.10** CanEver UnoZero, spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red) (20dB/vertical div.).

original vinyl version of the Band's so-so third album, *Stage Fright* (Capitol SW-425) with an AIFF ripped from the 2000 CD version (Capitol 25395-2), the latter played through the ZeroUno. Some distinctions fell along party lines: the LP sounded tonally richer, the digital file somewhat brighter and concomitantly more detailed and explicit. What I didn't expect was to hear the digital file convey more—and more realistic—information with regard to rhythmic nuance and sheer *bang*. Richard Manuel's crazy-loose drumming in "Strawberry Wine" was even crazier and looser through the ZeroUno, with more forceful snare-drum beats (a bit of a misnomer, as it sounds as though the snares on the bottom of the drum were left untightened for this number). And it was interesting how, at the end of the instrumental middle eight, the ZeroUno made the backing vocals—which sound as if they were actually discarded in the mix, but not before they'd bled into adjacent tracks—a bit easier to hear than on the LP. Apart from regretting the slight comparative leanness of the digital playback, that was the one I preferred.

Encouraged that the ZeroUno's greatest strengths had to do with its way with the most basic musical fundamentals, I turned to the simple arrangements on Bob Dylan's third album, *The Times They Are A-Changin'* (AIFF from CD, Columbia CK 8905). Tonally, the recording is far from perfect—pungent, peaky, grainy, with so little to recommend it spatially that the choice between stereo and mono versions is down to the flip of a coin. (The exception is the best-sounding song on the record, "Restless Farewell," which obviously benefits from being in stereo—the spatial presentation of Dylan and his guitar is more nuanced—and the sonic clarity of which well suited Dylan's arpeggio-happy picking.) Yes, the ZeroUno seemed to pile even more harmonics and texture on the sound of Dylan's already over-keening harmonica: insult visiting his friend injury for old times' sake. But the essence of the music—the literal meanings and impacts of the words, the relentless *sense* of the melodies, and, especially, the rhythmic nuances—was laid bare. Through lousy gear, Dylan's über-rubato performance of "With God on Our Side" can be maddening, frustrating: Here it was transcendently effective.

Moving back up the evolutionary ladder of arrangemental complexity, I tried the recording of Brahms's Clarinet Quintet by the Juilliard Quartet and clarinetist Charles Neidich (AIFF from CD, Sony Classical S2K 66285), and was not at all disappointed. Though not quite threadbare, the sound of this recording isn't the lushest out there, and while the ZeroUno didn't put lipstick on it, it did send it out of the house with clean underwear: strings were abundantly well textured, and Neidich's clarinet maintained its lovely colors even in the briskest phrases—and the notes he played in its lowest register revealed a convincing sense of the instrument's size. Again, and more important, the Italian DAC allowed the music exceptional and truly analog-quality melodic flow and temporal thrust and momentum. It's such a pleasure to hear, say, a *ritardando* phrase change tempo in a manner suggesting that fallible people and not infallible machines are doing the decelerating. That sort of accurate reproduction of minute qualities of sound and time is part of what constitutes realistic playback—and yes, it's the sort of thing one takes for granted with a good-quality record player.

A few words about scale—something else the ZeroUno was good at, though LPs still did a better job of allowing musical ensembles and recording venues to sound huge when called for. For example, the title track of Tom Petty and the Heartbreakers' *Echo* (AIFF from CD, Warner Bros. 47294-2) sounded convincingly big through the ZeroUno,

**measurements, continued**

–74dB (0.02%).

Tested for its rejection of word-clock jitter with S/PDIF J-Test data and its Jitter filter turned on (fig.13), the CanEver UnoZero's output spectrum revealed that all of the odd-order harmonics of the low-frequency, LSB-level squarewave were at the correct level (green line), but the spike that represents the high-level tone at one-quarter the sample rate was surrounded by sidebands spaced at 60Hz. These most likely stem from supply noise on the DAC chip's voltage-reference pin. Without the jitter filter, the data-rated sidebands were all still at the correct level, but now there was a 9.55kHz idle tone at –100dB.

The CanEver UnoZero offers respectable measured performance, with only its low-level noise signature and its intolerance of low load impedances hinting at the presence of vacuum tubes. But if you're interested in this DAC, keep its jitter and oversampling filters switched on.**—John Atkinson**

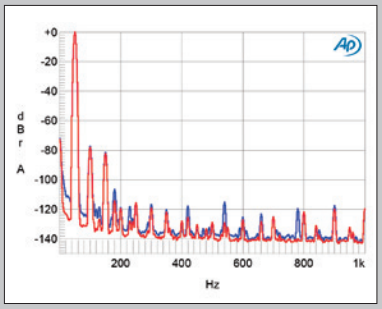


**Fig.11** CanEver UnoZero, spectrum of 50Hz sinewave, DC–1kHz, at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

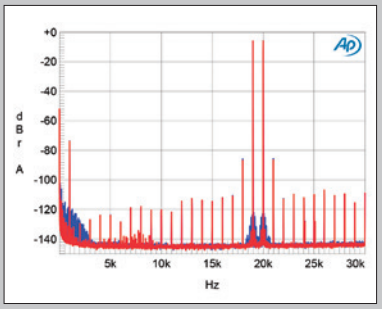


**Fig.12** CanEver UnoZero, Sharp filter, HF intermodulation spectrum, DC–30kHz, 19+20kHz at 0dBFS into 100k ohms, 44.1kHz data (left channel blue, right red; linear frequency scale).

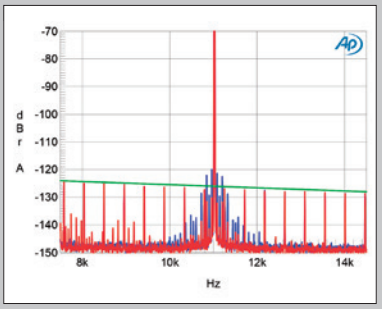


**Fig.13** CanEver UnoZero, Jitter filter on, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit TosLink data (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, 43.5kHz.

but even bigger when I played the LP (Warner Bros. 47294-1) on my analog front end (which includes the Hommage T2 phono transformer, a one-box bigness machine). Yet in making this observation, I should also acknowledge that this effect might actually be a distortion. There it is.

## Conclusions

With regard to the most musically fundamental elements of playback—rhythm, momentum, propulsiveness, the ability to convey a series of pitches as a string of musical notes with a human-ordained sense of flow—CanEver Audio's ZeroUno is the most capable DAC of my experience. It not only played music well, it let instruments and singers *sound* good: convincingly toned, richly textured, spatially palpable. Still, I never quite shook the impression that it was adding a bit of itself to those sounds.

How good was the ZeroUno? Good enough that, near the end of its time here, while double-checking my observations with certain recordings, I found it virtually impossible to listen to short snippets of music: When I tried to listen again to just a bit of Dylan's "With God on Our Side," one verse turned into the whole song, the song turned into the whole album, and the album turned into a retrospective of Dylan's early career. (I stopped halfway through *Bringing It All Back Home* only because I noticed it was getting dark and I hadn't walked the dog.) That sort of goodness makes a product hard to review and easy to love.

I don't know if this is *the* expensive digital source component I'd buy if I were interested in buying such a thing. Were I to spend this kind of money on a medium that would still remain my second choice, I'd have a hard time ignoring such a product as the Luxman D-06u ($9990), which offers a fine-sounding DAC and adds the flexibility of an SACD/CD transport. But while more flexible choices abound, and while cheaper choices are also thick on the ground, I've heard no other digital product that succeeds quite so well as the ZeroUno at letting music sound like music. Strongly recommended. ■

### ASSOCIATED EQUIPMENT

**Analog Sources** Garrard 301 turntable; EMT 997 tonearm; EMT OFD 15 & TSD 15, Ortofon SPU #1S, Shindo Laboratory SPU pickup heads; Denon DL 103 cartridge.
**Digital Sources** AudioQuest DragonFly, Halide Designs DAC HD USB DACs; Apple iMac computer (late 2015) running OS 10.12.1 & Roon v.1.2, Build 165; Sony SCD-777 SACD/CD player.
**Preamplification** Hommage T1 & T2 step-up transformers, Shindo Laboratory Masseto preamplifier.
**Power Amplifiers** Shindo Laboratory Corton-Charlemagne (monoblocks) & Haut-Brion (stereo).
**Loudspeakers** Altec Valencia, Auditorium 23 Hommage Cinema.
**Cables** USB: AudioQuest Carbon. Interconnect: Audio Note AN-Vx, Luna Red, Shindo Laboratory. Speaker: Auditorium 23. AC: Luna Orange, manufacturers' stock cords.
**Accessories** Box Furniture Company D3S rack (source & amplification components), Audiodesksysteme Gläss Vinyl Cleaner Pro.—**Art Dudley**